

A new species of *Namalycastis* (Polychaeta: Nereididae: Namanereidinae) from the shores of South-east Asia

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ABSTRACT

A new species of *Namalycastis*, *N. rhodochorde* sp. nov. (Polychaeta: Nereididae: Namanereidinae), is described from the shores of South-east Asia. At over one metre in length and bright pink in life, it is one of the largest and most spectacular species of Nereididae discovered. Apart from its extremely large size and unusual colour, the new species may be distinguished from other *Namalycastis* by having very short tentacular cirri, lacking spinigerous chaetae in both the reduced notopodia and the neuropodia (subaeicular position) of the parapodia, and in having many falcigerous chaetae in anterior parapodia that are either completely smooth or basally serrated (i.e. lacking teeth). The new species is currently wild harvested in its native range and exported alive to various countries for the bait trade, and therefore may become invasive.

KEYWORDS: Bait worm, *Namalycastis*, Namanereidinae, Nereididae, South-east Asia, taxonomy, new species, invasive species.

INTRODUCTION

The discovery of a new species of large (over one metre long), bright pink polychaete worm living intertidally near highly urbanised centres is somewhat unusual. Local inhabitants of South-east Asia have undoubtedly been aware of the existence of this polychaete species on their shores for some time, but it was not until 1993–94 when worms were exported live from Vietnam to the United States and Japan that it became more widely known around the world, especially among fishers and the environmental law enforcement officers. At about the same time, the species was identified by polychaete taxonomists either as *Namalycastis abiurna* or *N. cf. brevicornis* or *Namalycastis* sp. (Nereididae: Namanereidinae) and some of these names have been used subsequently in the media and in the literature (e.g. Sherfy and Thompson 2001). In a revision of the subfamily Namanereidinae, Glasby (1999: 34) referred to a specimen of the same species from Cochinchina, Vietnam, under the name *Namalycastis abiurna* species group, noting its unusual morphology. However, re-examination and comparison of this specimen with those of the new species described herein revealed it to be the same species.

In early 2007, one of us (J) collected specimens of this species in the mangroves of the Kakap estuary (Sungai Kakap), near Pontianak, West Kalimantan, Indonesia. The West Kalimantan specimens are here designated as types of a new species. Tissue samples from one of the types and from a specimen from the Mekong River delta, Vietnam, were also taken and the results of this analysis will be reported separately in a study on the phylogeny of the Namanereidinae by CJG. A few months earlier at Kota Kinabalu, just over 1000 km NE of Pontianak on the same island (Borneo), photos (Fig. 1) and video of what we believe to be the same species foraging on the mangrove shores were taken by Murphy Ng. The purpose of the present study is to name formally and describe this spectacular species and to collate the available information on its biology especially in relation to its commercial exploitation.

MATERIAL AND METHODS

Specimens were examined and photographed using a Nikon SMZ1500 dissecting microscope and a Nikon Eclipse 80i compound microscope, with an interchangeable Qimaging Micropublisher 5 RTV digital camera. Chaetae

were photographed using both transmitted light and differential interference optics (DIC), as indicated. The morphological character set and terminology follows Glasby (1999). Abbreviations used include: CMNH, Coastal branch, Natural History Museum and Institute of Chiba, Chiba, Japan; MNHN, Muséum national d'Histoire naturelle, Paris, France; NTM, Museum and Art Gallery of the Northern Territory, Darwin, Australia; OMNH, Osaka Museum of Natural History, Osaka, Japan; UMAM, Agricultural Museum, University of Miyazaki, Japan; USNM, National Museum of Natural History, Smithsonian Institution, USA.

SYSTEMATICS

Family Nereididae

Subfamily Namanereidinae

Genus *Namalycastis* Hartman, 1959

Namalycastis rhodochorde Glasby, Miura, Nishi and Junardi sp. nov.

(Figs 1–8)

Material examined. HOLOTYPE – NTM W21210, Indonesia, Sungai Kakap, 19 km west of Pontianak,

West Kalimantan, 0°3.1'S, 109°10.0'E, mangrove area, sediment associated with *Nypa* palms (*Nypa fruticans*), coll. Junardi, April 26, 2007. PARATYPES – location and collection details as for holotype: 1 (NTM W21211), 2 (NTM W21212), 1 (USNM 1109992), 1 (OMNH IV5026). NON-TYPE – Vietnam, probably Mckong Delta (no further information), specimens sourced from bait shops in USA and Japan, 2 (USNM 174088), 2 (USNM 1109993), 1 (USNM 1109994), 2 (NTM W19067), 4 (NTM W21213), 1 (NTM W21214), 2 (NTM W21215), 1 (CMNH ZW1656), 1 (CMNH ZW1657), 5 (UMAM unreg.), 1 (UMAM unreg., materials for chemical analysis by Mizuta *et. al.*, 2005). 28 specimens examined.

Comparative material examined. *Namalycastis abiuma* species group, 1 specimen (MNHN UE932), Cochinchine [= Vietnam], coll. Haffner, 1893.

Description of holotype and paratypes (in parentheses). Holotype and paratype (NTM W21211) preserved in 10% formalin; other paratypes preserved in 80% ethanol. Holotype 650 mm long, 10 mm at chaetiger 10 (with parapodia) for 708 segments (posterior end missing, pygidium regenerating). Paratypes 460 mm long, 8.2 mm wide at chaetiger 10 for 393 segments (complete) to 160 mm long, 4.0 mm wide at chaetiger 10 for 605



Fig. 1. *Namalycastis rhodochorde* sp. nov. photographed alive at high tide in the mangroves of the Kota Kinabalu Wetland Centre, Kota Kinabalu, Sabah, Malaysia, A, Entire animal, length about 30 cm; B, close-up of head. Photos: Murphy Ng, 5 August 2006.

segments (posterior end missing, pygidium regenerating). In life, typical size range from 0.3–1.5 m in length, with some specimens reaching 3 m (M. Lopuszanski, pers. comm. 2002).

Body and colouration. Uniform in width anteriorly to about midbody, then tapering gradually posteriorly. Dorsum convex. Venter flat or with shallow ventral groove (some paratypes). In life, worms are normally bright pink-coloured. Preserved specimens straw-coloured, light tan or greenish (mature males); additional epidermal pigment absent.

Prostomium. Prostomium cleft anteriorly, with narrow deep longitudinal groove extending from tip to mid-posterior prostomium (Fig. 2A). Prostomium shape triangular to quadrangular, $1.6 \times$ wider than long (1.5–2.4). Antennae short subconical, extending short of, to level with, end of palpophore, aligned over mid-palps to inner edge of palps. Palps massive, biarticulate, with spherical paplostyle (Fig. 2B). Eyes 2 pairs, deeply embedded within epidermis (almost invisible in holotype), purple-black, arranged obliquely, posterior pair slightly smaller.

Peristomium and pharynx. Peristomium similar in length to first chaetiger. Tentacular cirri, 4 pairs, short with cirrophores distinct, comprising basal 1/3 total length

of cirri, except for posterodorsal pair, which comprise about $\frac{1}{2}$ length of cirri; cirrostyles smooth (Figs 2A, B). Anterodorsal tentacular cirri $1.0 \times$ length anteroventral (1.1–2.0). Anterodorsal tentacular cirri $0.5 \times$ length posterodorsal (0.7–0.9). Posterodorsal tentacular cirri $2.0 \times$ length posteroventral (1.2–2.0). Posterodorsal tentacular cirri extending posteriorly to posterior chaetiger I (2–3). Pharynx lacking paragnaths, with pair large jaws, black with single, robust terminal tooth, 5 subterminal teeth (3–6) and wide gap between terminal and first subterminal tooth most pronounced in large specimens.

Parapodia. Each parapodium comprising dorsal cirrus, acicular neuropodial ligule and ventral cirrus (Fig. 3). Dorsal cirri triangular throughout, becoming flatter from anterior-mid body and increasing slightly in size relative to acicular ligule (Fig. 4); cirrostyle relatively larger on anterior segments (Figs 4A, B) compared to middle and posterior segments where it is restricted to a small distal papilla (Figs 4C–H). Acicular neuropodial ligule weakly bilobed distally; superior lobe papilliform, inferior lobe globular (Fig. 3). Ventral cirri, small, conical, decreasing slightly in size relative to acicular ligule from anterior-mid body (Fig. 4A–H).

Chaetae. Notochaetae absent. Supra-neuroacicular chaetae include sesquigomph spinigers (Fig. 5A) in postacicular fascicles and heterogomph falcigers (Fig. 6A) in preacicular fascicles. Sub-neuroacicular chaetae comprise only heterogomph falcigers (Fig. 6B) (spinigers absent in holotype but very rarely present in some paratypes and non-types; see variation), numerous, arranged in deep arc around the inferior lobe (Table 1; Fig. 3). Supraneuroacicular falcigers in chaetiger 10 with blades $4.8 \times$ longer than width of shaft head (4.0–4.3), smooth except for few serrations near base of blade (Fig. 6A). Subneuroacicular falcigers in chaetiger 10 with blades also smooth apart from few basal serrations; dorsal-most $5.0 \times$ longer than width of shaft head (3.9–4.3); ventral-most $5.0 \times$ longer than width of shaft head

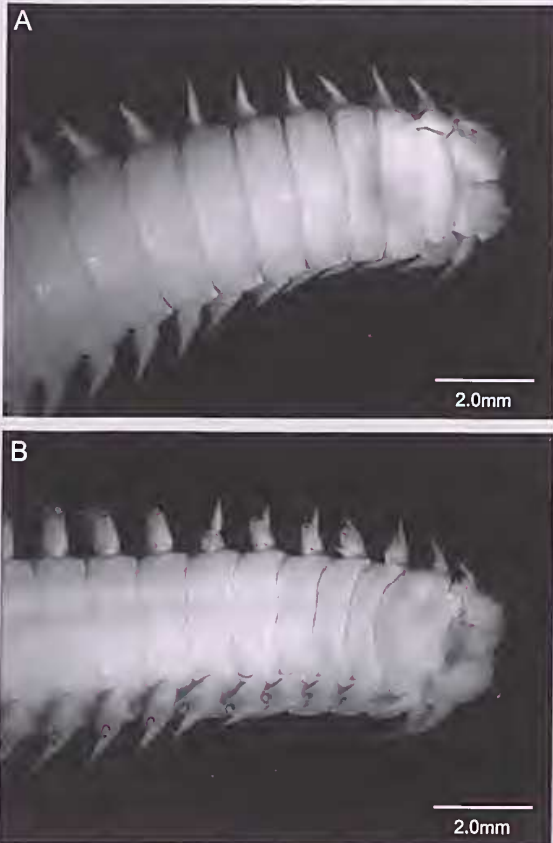


Fig. 2. *Namalycastis rhodochorde* sp. nov. holotype (NTM W21210): A, dorsal view of anterior end; B, ventral view of anterior end.

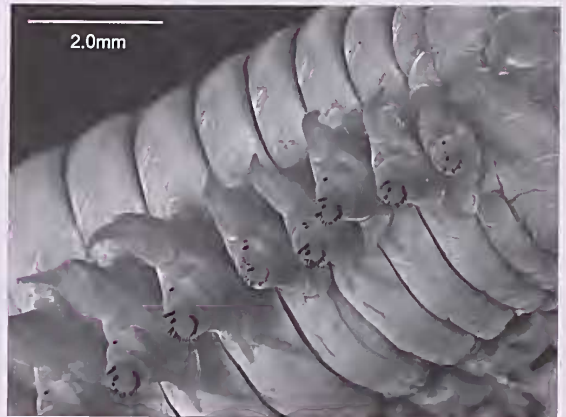


Fig. 3. *Namalycastis rhodochorde* sp. nov. Non-type (NTM W19067). Lateral view of first eight chaetigers showing arrangement of chaetae in relation to neuropodial lobes and neuroaciaculac.

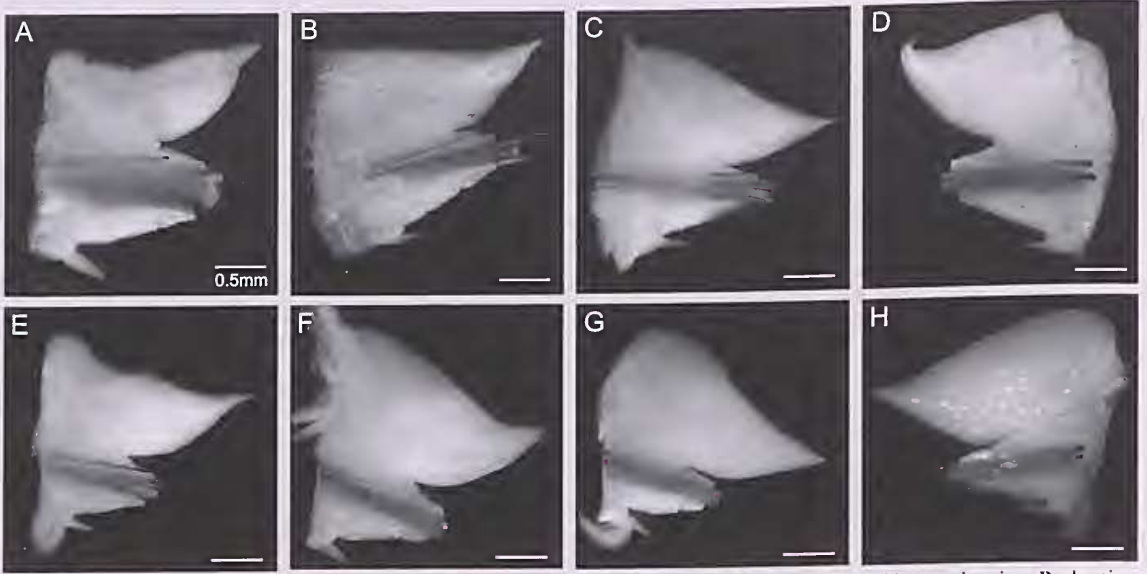


Fig. 4. *Namalycastis rhodochorde* sp. nov. holotype (NTM W21210), parapodia from A, chaetiger 10, left side, anterior view; B, chaetiger 100, right side, posterior view; C, chaetiger 200, left side, anterior view; D, chaetiger 300, left side, posterior view; E, chaetiger 400, left side, anterior view; F, chaetiger 500, right side, posterior view; G, chaetiger 600, right side, posterior view; H, chaetiger 700, left side, posterior view. Scale bars all 0.5 mm.

(3.3–4.0) (Fig. 6B). Sub-neuroacicular falcigers in mid-posterior region with blades as for those in chaetiger 10, but serrations sometimes absent in ventralmost falcigers. Chaetae golden coloured. Aciculae black.

Pygidium. Pygidium weakly multi-incised. Pair of short (less than pygidium width), ventrolateral anal cirri, approximately conical.

Variation. Non-type material ranges in size from 365 mm long, 9.0 mm wide at chaetiger 10 for about 400 segments (complete, posteriorly regenerating) to 960 mm long, 10.9 mm wide at chaetiger 10 for 687+ segments (posterior end missing). Subneuroacicular heterogomph 'spinigers' rarely present – for example the larger specimen in USNM 174088 had only two chaeta of this type in parapodia of the first and last 50 chaetigers; however, close examination of the 'spinigers' shows that they are more likely to be homologous with falcigers as the blade is short and is serrated basally like falcigers (Fig. 6C), rather than along the entire length of the blade as in true nereidid spinigers. Therefore they are best referred to as long-bladed falcigers. Other features including morphometry is within the range exhibited by the types.

Etymology. The species epithet is combination of the Greek words for rose, *rhodon*, and rope, *chorde*, after its distinctive bright rose-pink colouration in life and long, cord-like appearance. It is a noun in apposition.

Common names. Magic cord worm (US), Nuclear worm (US), Super cordelle worm (Japan, France), *cacing nipah* (Bahasa Indonesia; *cacing* meaning worm and, *nipah* referring to the specific habitat of the mangrove palm, *Nypa fruticans*).

Habitat. In its native range in South-east Asia, the species inhabits the mud banks and mudflats of estuaries and rivers from full seawater to almost freshwater, and appears to be strongly associated with the mangrove palm. It feeds on rotting plant and detrital material.

Distribution. South-east Asia (Sunda shelf only) including Mekong Delta (Vietnam), West Kalimantan (Indonesia) and Sabah (Malaysia). Suitable habitats, including *Nypa fruticans*, are apparently present as far south as northern Australia (Melville Island and Cobourg Peninsula in the Northern Territory and North-east Queensland) and northward to southern Japan (Yaeyama Islands), so there is a possibility that the species also

Table 1. Numbers of chaetae in neuropodia of selected chaetigers. Numbers are approximate for the subacicular region because the extreme thickness of section obscured clear view of the chaetae. Numbers in holotype given first, followed by range in paratypes in parentheses.

Chaetiger No.	Supra-acicular chaetae	Subacicular chaetae	
	Sesquigomph spinigers	Heterogomph spinigers	Heterogomph falcigers
10	6 (3–6)	6 (3–5)	45 (20–30)
100	6 (3–5)	5 (2–4)	20 (8–23)
200	6 (2–3)	7 (2–4)	16 (6–12)
300	4 (2–3)	3 (1–3)	11 (6–16)
400	4 (2–3)	4 (3)	11 (10–12)
500	3 (2–3)	3 (2)	11 (8–10)
600	2 (2)	3 (2)	11 (8)
700	3	1	11

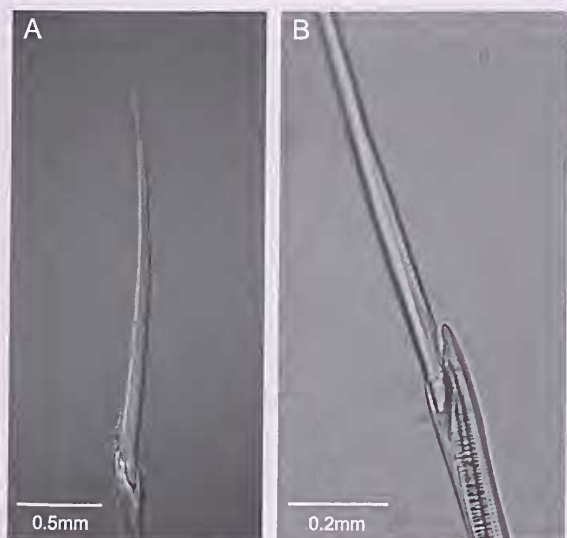


Fig. 5. *Namalycastis rhodochorde* sp. nov., A, holotype (NTM W21210), sesquigomph spiniger from chaetiger 11; B, Non-type (MNHN UE932), sexually acquired heterogomph spiniger from chaetiger 50.

occurs there, or if not native to these areas, could become established if introduced.

Taxonomic remarks. *Namalycastis rhodochorde* sp. nov. may be distinguished from other species in the genus by the combination of very large size, bright rosy pink live colouration (and lack of additional pigment on dorsal surface), very short tentacular cirri, lack of notochaetae and subneuroacicular spinigers, the presence of toothless, short-bladed falcigers, and the high number of falcigerous chaetae in the neuropodia of anterior chaetigers. The only other species in the genus that lacks

subneuroacicular spinigers, *Namalycastis hawaiiensis* Johnson, has a broad Indo-west Pacific distribution and likely overlaps with the new species in the Sunda region (Java and Sumatra), although it is only found in freshwater (Glasby 1999; Glasby *et al.* 2003). *Namalycastis hawaiiensis* further differs from the new species in having a smaller body size (11–81 mm in length), being white rather than pink, having falcigerous chaetae with a large proportion of the blade serrated, and coarsely-toothed spinigerous chaetae in posterior chaetigers.

The new species is also similar to *Namalycastis abinma* and *N. terrestris*; however, both of these differ from the new species by having falcigerous chaetae with serrated blades and spinigerous chaetae in the subneuroacicular fascicle of the neuropodia; additionally, *N. abinma* has chocolate brown pigmentation in the anterodorsal body and pygidium. Re-examination of a mature male specimen from Cochinchina, Vietnam (MNHN UE932), identified as *Namalycastis abinma* species group by Glasby (1999) showed it to be *N. rhodochorde*. This specimen is very large at 250 chaetigers (last few missing), 340 mm long, 8 mm wide at chaetiger 10 (12 mm maximum) and lacks teeth on the falciger blades. In addition to the normal complement of chaetae, the specimen has pale, thin (about half normal thickness) heterogomph spinigers (Fig. 5B) in the noto- and neuropodia of all chaetigers except for first and last few (Fig. 7). Because of their appearance, number and distribution they are presumed to be acquired during sexual maturation prior to spawning, and therefore may be analogous to the paddle-like epitokous chaetae of other Nereididae. The only other morphological differences between the Cochinchina specimen and the others examined here are that the eyes appear to be slightly larger and the body has a greenish tinge (compare Figs 8A, B).

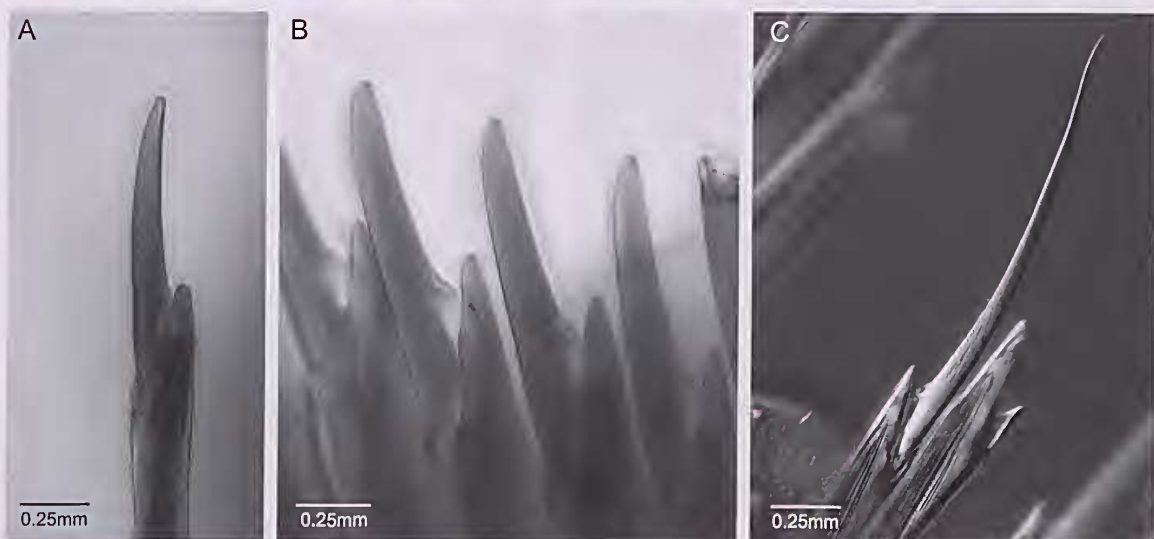


Fig. 6. *Namalycastis rhodochorde* sp. nov., A, holotype (NTM W21210), supra-acicular neuropodial falciger from chaetiger 100; B, holotype (NTM W21210), subacicular neuropodial falcigers from chaetiger 500; C, Non-type (USNM 174088), subacicular neuropodial long-bladed falciger from posterior-most chaetiger (DIC optics).



Fig. 7. *Namalycastis rhodochorde* sp. nov. Non-type (MNHN UE932), lateral view of parapodia of midbody showing normal and sexually acquired chaetae.

Similarly, two sexually mature specimens from rice fields at Phuoc Dienha near Cholon, Ho Chi Minh City, South Vietnam, identified as *Namalycastis terrestris* by Glasby (1999) are also likely belong to the new species. Although the specimens could not be located in the MNHN to re-examine them, checking of original notes made on the specimens indicates that the numbers of chaetae in all areas was much greater than that of the lectotype of *N. terrestris*, and we now suspect that the high count was due to the inclusion of these sexually-acquired chaetae.

Biology. In the Mekong River delta the species spawns from September–November with females becoming red and the males green, and both becoming good swimmers (M. Lopuszanski, pers comm. 2002). This agrees with the information on the label of specimens from Cholon (includes a sexually mature female), which says that they were present in rice fields from July–October (rainy season) when they were inundated by a mixture of freshwater and brackish water. The reproductive season in other parts of its range is not known; one of us (J) is currently studying the reproductive biology of the population in the Sungai Kakap, West Kalimantan, Indonesia. Other ongoing studies on the biology of *N. rhodochorde* include those of Timothy Mullady (Smithsonian Environmental Research Center) who is investigating potential pathogens and harmful symbionts carried by the worms introduced to the US, and one by Doug Miller (University of Delaware) who is coordinating a study on the physiological tolerances, reproduction and regenerative abilities of the species to determine its potential for introduction into the US. Although the species normally inhabit tropical environments and do not survive well in temperatures below 20°C (M. Lopuszanski, pers comm. 2002), they can survive in captivity to near 12°C if acclimated slowly (Delaware Aquaculture Resource Center, Sea Grant fact sheet; <http://darc.cms.udel.edu/ansr/factsheet.doc>).

Bait trade. Normandy Appâts (http://www.jcpoint.com/bapw/peche/amorces_appats/vers_de_mer.htm) has



Fig. 8. *Namalycastis rhodochorde* sp. nov.: A, Non-type (NTM W19067), anterior end dorsal view; B, Non-type (MNHN UE932), mature male showing green colouration and enlarged eyes.

been exporting this species from the Mekong River Delta in Vietnam to the United States and Japan, via France, since 1993, although it was not available in bait shops in the Kanto Region of Japan (includes Tokyo, Chiba, Kanagawa) in 2007 (E. Nishi, pers. obs.). In California the trade dates back to at least August 1994 when specimens were brought to the California Academy of Sciences for identification (Richard Everett, pers. comm. 1996). The species may have also been exported to Europe, although a survey of marketable worms being imported into Portugal did not indicate the presence of this species (Fidalgo e Costa *et al.* 2006). The worms are sold for fish bait under the trade names 'Magic eord worm' or 'Nuclear worm' (USA) and 'Super Cordelle' (Japan). They are maintained in plastic boxes containing fermented paper pulp, then transported alive in sealed cans, 30 g per box (two worms minimum). Their natural tolerance to hot, low-oxygen conditions and a semi-terrestrial environment make this type of transport possible. Further, the worms make particularly good bait because they are tolerant of wide salinity variations and like many other polychaetes can be cut into sections, with the segments remaining alive for some time.

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